International Journal of Civil Engineering (IJCE)
ISSN(P): 2278-9987; ISSN(E): 2278-9995
Vol. 4, Issue 2, Mar 2015, 27-34

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

MAPPING AND MONITORING LAND USE /LAND COVER CHANGES OF AN UNGAUGED WATERSHED OF VEERANAM TANK, CUDDALORE DISTRICT, INDIA

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ABSTRACT

Veeranam tank, Cuddalore district is the second largest tank in Tamil Nadu, which has an ungauged catchment. Land use, is one of the important parameter which determines the runoff in the watershed. This study attempted to identify Land Use/ Land Cover (LU/LC) changes in the study area. The satellite imageries of the year 1986, 1996 and 2005 are acquired from the IRS, Anna University, Chennai to derive LU/LC maps. Remote sensing and GIS software is used to recognize the LU/LC changes. The classification results show that this area has twelve classes of LU/LC such as crop land, Fallow land, Forest plantations, Forest Blanks, scrub forest, Gullied/ravenous land, Land without scrub, Reservoir/tank, River (stream), Settlements, and Salt affected areas as per Level 3 classification. Changes between different land use categories are assessed. The change detection obtained from LU/LC would be used for the prediction of runoff of the watershed. The study reveals that there is change in crop land and plantation. 78.55 km^2 of crop land and 254.885 km^2 of plantation changed to other categories, namely water bodies, built-up, Land with scrub, Land without scrub, current fallow and forest Blanks.

KEYWORDS: LU/LC, Land Use Imageries, Remote Sensing and GIS, Ungauged Catchment

INTRODUCTION

The amount of expected runoff of vegetated land use types such as forests, which are not affected by the surface and soil physical properties, but by the uptake capacity of the vegetation present. (Lynn. E Johnson, 2009) LU/LC is distinct yet closely linked characteristic of the Earth's surface. Changes in land use and land cover are key factors for global environmental change. Land use is a product of interactions between a society's cultural background, state and its physical needs on the one hand, and the natural potential of land on the other (Ram and Kolarkar 1993). Singh (1989) described change detection as a process that observes the differences of an object or phenomenon at different times. Remote sensing and GIS plays a vital role at the stages of exploration and analysis of local resources, planning and evaluation. Remote sensing and GIS in the assessment and percentage of change of LU/LC is used increasingly (Iverson et al, 1994, Apan et al, 2002). Temporal change in land cover has become possible in less time, at lower cost, and with better accuracy through remote sensing technology (Kachhwala, 1985) The information being in digital form can be brought into a Geographical Information System (GIS) to provide a suitable platform for data analysis, update and retrieval. Improvements in satellite remote sensing, global positioning systems and geographic information systems techniques in the past decade have greatly assisted with the collection of land cover data and the integration of different data types (Star et al, 1997). High temporal resolution, precise spectral bandwidths, and accurate georeferencing procedure are factors that

contribute to increase the use of satellite data for change detection analysis (Jensen, 1996). The land cover describes the physical appearance of the earth's surface, while land use is a land right related category of economically using the land. (Konecny 2003). Land use information, coupled with the hydrologic characteristics of soils on the land surface, can also provide measures of expected percolation and water holding capacity (Nagarajan and Poongothai, 2011).

The main objective of the study is

- To detect that changes have occurred.
- To identify the nature of change of Land use/Land cover over past 19years
- To measure the areal extent of change.

StudyArea

The study area lies between 11°15' and 11°15' North latitudes and 79°30' and 79°35' East longitudes situated in Cuddalore District and 24 km west of Chidambaram in Tamil Nadu, is stretching from Kattumannarkoil to Sethiyathope. The study area is land locked by Villupuram District in the north, Salem, Nammkal in the west and Perambular and Ariyalur District in the south and the Bay of Bengal in the east. The tank lies between the Vellar and Kollidam rivers in the Eastern Coastal plain tract. The Veeranam tank has a tropical climate with a hot summer and a mild winter. Agro-climatically the area falls under the group of semiarid regions. Figure 1 Shows the Study area map.

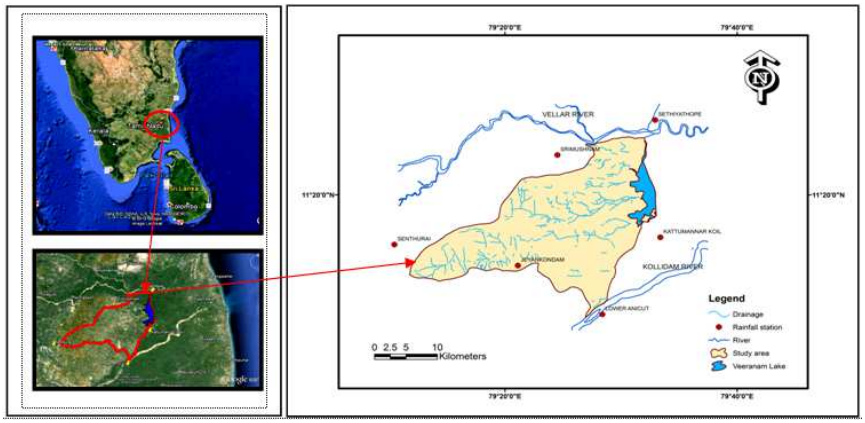

Figure 1: Map showing the Study Area

MATERIALS AND METHODS

Survey of India topographical map sheets of scale 1:50000 and interpreted satellite maps of IRS-IC, LISS III data and LISS III with PAN merged data for the year 2005 was collected from IRS, Anna University, Chennai.

The ground truth verification was carried out and the tonal variation representing the different classes was incorporated on the hard copy image 1986, 1996 and 2005. Overlay analysis of GIS is used to identify the LU/LC changes in the study area.

RESULT AND DISCUSSIONS

The maps obtained from the IRS for the year 1986, 1996 and 2005 were digitized and rasterised by using Arc GIS 9.3 Software. The changes that have occurred in total area is presented in (Table 1), Figure 2 (1986), Figure 3 (1996), and

Figure 4 (2005) show the LU/LC map of the study area. The area of crop land changed into other land use categories such as water bodies, forest plantations,built-up,land with scrub, land without scrub, plantations, current fallow is about 78.652 Km^2. Forest plantations changed to other categories is about 0.797km^2. Plantations changed into other categories is about 16.95 km^2. Reservoir/Lake/Tank into other categories is about 4.856Km^2. Rural settlement villages to other categories is about 36.34 Km^2. Salt affected to other categories is about 0.5 Km^2.

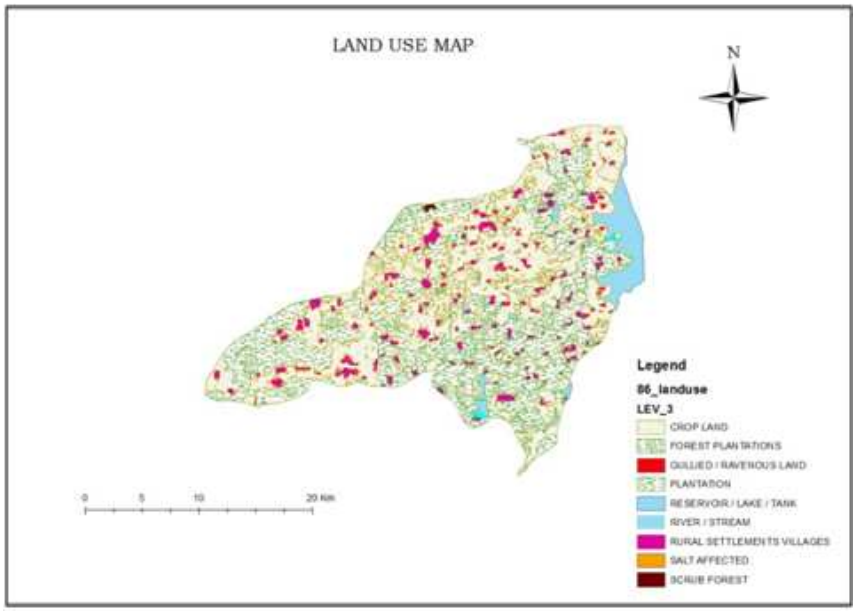

Figure 2: Land Use Map of Lower Coleroon River Watershed (4B1A5f & 4B1A5e , 1986)

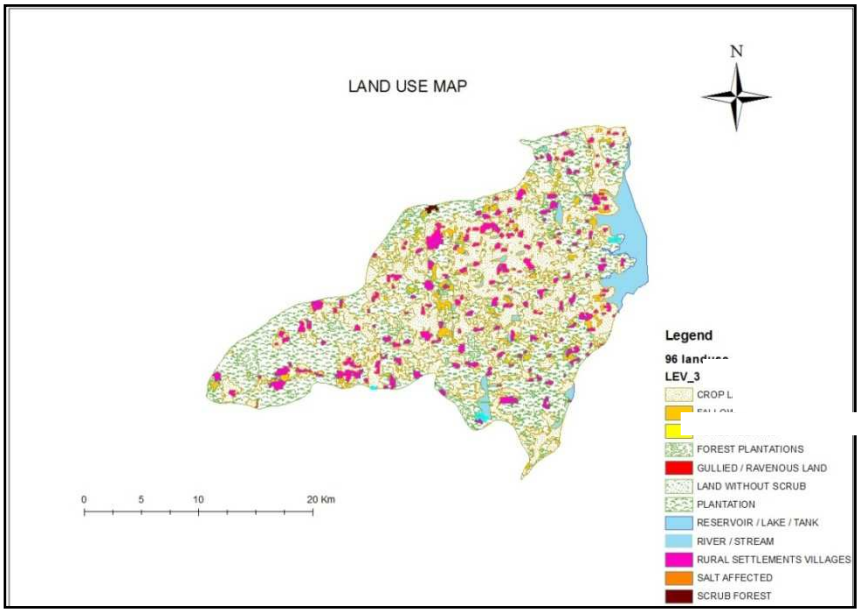

Figure 3: Land Use Map of Lower Coleroon River Watershed (4B1A5f & 4B1A5e, 1996)

Scrub forest to other categories is about 0.416 km^2. Land use category Settlements in this study area is decreased from 7% to 5% due to Mining/Industrial activities in the study area. Due to more agricultural activities in the watershed there is an interchange of cropland to plantation and plantation to crop land. The changes mentioned above are presented in Figure 5 and Table 2.

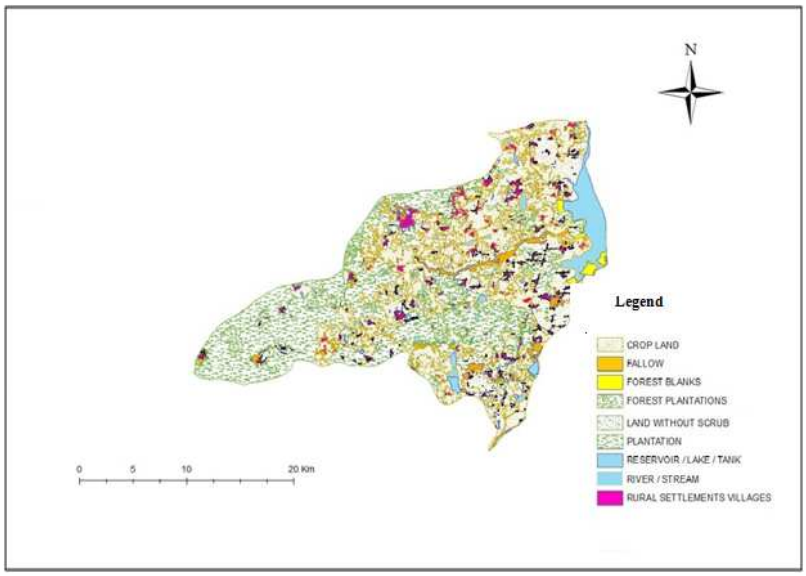

Figure 4: Land Use Map of Lower Coleroon River Watershed (4B1A5f & 4B1A5e, 2005)

CONCLUSIONS

In this catchment, most of the area is covered by crop land (45%) and plantation (36%) As per the analysis, crop land is increased by about 5% and plantations have decreased by 7% and settlements have decreased by 2%. It also reveals that the increase or decrease in cropland or plantation is only a minor percentage which may not have a serious impact over runoff. In this connection this study may be useful in taking decisions about land use plans and assessing runoff in watersheds. The study area is an agricultural watershed having an increase in the percentage of crop land from 40% to 46% of the total area of the watershed due to the conversion of plantation to cropland and decrease in percentage of plantations from 43% to 36% due to the conversion of plantation to other land use categories , which is a smaller percentage would create a moderate impact over runoff.

Table 1: Land Use /Land Cover of the Study Area (1986-2005)

S. No	Land Use	Area in 1986		Area in 1996		Area in 2005	
		Km^2	%	Km^2	%	Km^2	%
1	Cropland	217.85	40.125	169.82	31.277	248.52	45.773
2	Fallow land	0	0	14.37	2.6467	12.78	2.3538
3	Forest plantations	11.857	2.1838	11.77	2.1678	11.318	2.0845
4	Forest blanks	0	0	0.08	0.0147	4.658	0.857922
5	Scrub forest	0.538	0.0990	0.538	0.0990	0	0
6	Gullied/ravenous land	0.099	0.0182	0.101	0.0186	0	0
7	Land without scrub	0	0	0.043	0.0079	3.186	0.586805
8	Plantation	234.58	43.206	260.1	47.9240	196.54	36.1997
9	Reservoir/Tank	40.277	7.4183	40.27	7.4183	38.869	7.15898
10	River(stream)	0.306	0.0563	0.306	0.0563	0	0
11	settlements	36.886	6.7937	44.86	8.2624	27.071	4.98600
12	Salt affected areas	0.532	0.09798	0.576	0.1060	0	0
Total		**542.94**	**100**	**542.94**	**100**	**542.945**	**100**

Table 2: Area Wise Change Detection of the Study Area

Existing Land Use	Present Land Use	Area(Km^2)
Crop land	Water bodies	3.215
Crop land	plantations	59.850
Crop land	Land with scrub	0.123
Crop land	Built-Up	5.717
Crop land	Current fallow	7.273
Crop land	Land without scrub	2.330
Crop land	Forest Plantations	0.048
		78.556

Table 3

Existing Land Use	Present Land Use	Area(Km^2)
Forest plantations	Crop land	0.115
Forest plantations	Forest blanks	0.234
Forest plantations	plantations	0.452
Forest plantations	Sandy area	0.007
		0.797

Table 4

Existing Land Use	Present Land Use	Area(Km^2)
Plantation	Crop Land	92.492
Plantation	Water Bodies	42.045
Plantation	Built-up	36.798
Plantation	Land with scrub	0.659
Plantation	Land without scrub	2.738
Plantation	Current fallow	63.223
Plantation	Forest plantations	15.035
Plantation	Dense	1.656
Plantation	Forest Blanks	0.239
		254.885

Table 5

Existing Land Use	Present Land Use	Area(Km^2)
Reservoir/Lake/Tank	Crop Land	3.326
Reservoir/Lake/Tank	Built -up	0.304
Reservoir/Lake/Tank	Land Without Scrub	.002
Reservoir/Lake/Tank	Plantations	1.230
		4.862

Table 6

Existing Land use	Present Land use	Area(Km^2)
Rural Settlements villages	Crop Land	11.981
Rural Settlements villages	Built-up	15.046
Rural Settlements villages	Water Bodies	0.572
Rural Settlements villages	Current Fallow	0.595
Rural Settlements villages	Plantations	8.147
		36.341

Table 7

Existing Land Use	Present Land use	Area (Km^2)
Salt affected	Crop land	0.287
Salt affected	Plantations	0.219
Salt affected	Water Spread area	0.024
Scrub Forest	Forest Blanks	0.035
Scrub Forest	Forest Plantations	0.344
Scrub Forest	Plantations	0.037
Gullied/Ravenous Land	Plantations	0.099
		1.045

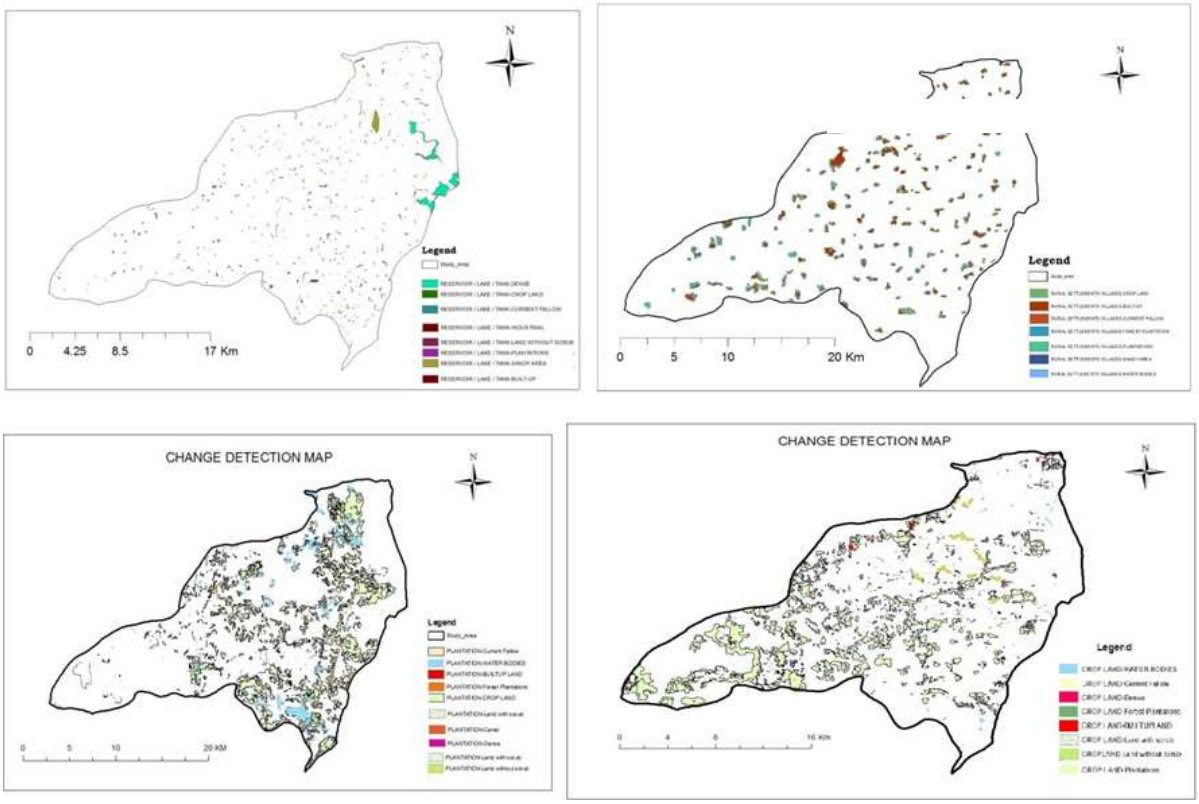

Figure 5: Change Detection Map of the Study Area

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